

XIII. *Mimetic resemblances between species of the Coleopterous genera Lema and Diabrotica.* By CHARLES J. GAHAN, M.A., F.E.S., Assistant in the Zoological Department, British Museum.

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PLATE XVII.

WHEN, a short time ago, I began to work at the phytophagous genus *Diabrotica*, I was somewhat puzzled to account for the strangely familiar appearances of some of the species; for I had never any reason, until then, to examine them very closely. Upon a little reflection, however, I suspected that, by looking into the cabinet drawers containing the species of *Lema*, which I had not long before arranged, I should be able to find the needful explanation. This suspicion proved correct. Certain species of *Lema* were seen to have the closest resemblance in colour and marking to those species of *Diabrotica* which had so perplexed me.

If only one or two out of the five hundred species of *Lema* resembled one of the four hundred or more species of *Diabrotica*, the fact need not be considered very extraordinary; but it certainly does seem deserving of notice that as many as fifteen or sixteen species of the one genus should present the most striking analogical resemblances to corresponding species of the other. The resemblance, it need scarcely be said, was found to be most pronounced between specimens from the same localities.

It would be fruitless to attempt to convey by description a clear idea of the similarity in colour and style of marking; so that I do not intend to give here more than a brief indication of the points of resemblance between a few of the species.

In *Diabrotica 10-guttata*, Oliv. (see Baly)—a very variable species, occurring abundantly in the Amazonian regions—the head is black, the eighth and ninth joints of the antennæ are whitish, the remaining joints brownish

black; the prothorax is yellowish tawny; the elytra, in typical examples, have a shining brownish black colour, and each is marked with five rounded tawny spots arranged in the order 2, 2, 1. The femora are fulvous, the tibiæ and tarsi black. A repetition of these details would almost exactly describe the coloration and style of marking of *Lema Batesii*, Baly, a species from the same regions. In this species, however, the two middle spots of each elytron are usually united to form a sort of transverse band.

In one variety of *D. 10-guttata* nearly all the black colour is obliterated from the basal three-fourths of the elytra; the apical spot on each remains surrounded by a somewhat irregular black border. This variety occurs in Ecuador and the Upper Amazons, and has its counterfeit in a species of *Lema* (*L. oculata*, Lac.), also from Ecuador.

*Lema nigrovittata*, Guér., found in Mexico and North America, has the elytra striped with black and yellow in close imitation of *Diabrotica vittata*, Fab., which is very common in the same localities.

Other striped species of the two genera are very much alike. The most remarkable, perhaps, are the Mexican species, *L. bisbivittata*, Clark, and *D. Fairmairei*, Baly. They are of about the same size. The pale yellow stripes of their elytra correspond almost exactly in position and in width. The elytra have in each species the same peculiar violet-brown ground colour, and they are, moreover, raised into narrow longitudinal costæ between the rows of punctures with which they are impressed. So that in colour, sculpture, and pattern of marking the elytra in the two species offer a strong resemblance.

It is not often that two species of different genera are more deceptively alike than *L. dimidiaticornis*, de Borre, and *D. lepida*, Say. These are also found in Mexico. The head and prothorax in both are of the same reddish colour. In *D. lepida* the elytra are glossy black, and each is marked with two confluent ivory-like spots near the middle, with a similar spot near the apex. In *L. dimidiaticornis* the elytra have a glossy bluish black colour, and are each marked with a transverse yellowish band at the middle, and with a spot of the same colour near the apex. The transverse band is often slightly constricted in its middle, so that it comes more closely to resemble the two confluent spots occupying a similar position in the *Diabrotica*.

*Lema Buckleyi*, Baly, and *Diabrotica elegans*, Baly, both from Ecuador, are extremely alike. The general tone of colour in each is a pale yellow. The elytra are crossed by two bright metallic-blue or green bands—one at the base, the other behind the middle. These bands in the two species correspond exactly in shape, extent, and position. Given the outline of one species to fill in, and the other species as a model from which to copy, it would be difficult for an artist to more faithfully reproduce the colours and design than Nature has done in this case.

It is a rather happy coincidence in nomenclature that the same specific name has been applied to a *Diabrotica* and a *Lema*, both from Central America, and both closely resembling each other. This name—*biannularis*—pretty well expresses the character common to the two species. In each the pale yellow elytra carry four somewhat circular metallic-blue figures. The two basal figures are usually complete circles, the two posterior figures are generally crescentic or arcuate in form.

Sufficient has been stated to show that the resemblances are not confined to species exhibiting one particular kind of pattern, but that almost every style of marking occurring in the genera is represented among the imitative forms.

It remains for me now to offer some explanation of the resemblances here recorded. I believe they are cases of true “mimicry”; that the species of *Diabrotica* are protected, and that the species of *Lema* derive advantage by mimicking them. At first it might seem that the Lemas, owing to the harder covering of their bodies, were the protected species, and that the softer-bodied *Diabroticas* were the *mimics*, just as certain Longicorns and other beetles mimic the hard *Curculionidæ*. But the following considerations will, I think, bear out in some measure the opinion which I have expressed.

The species of *Diabrotica* are very numerous in individuals, some of them occurring in swarms in the localities in which they are found. A considerable variety of colour and style of marking runs throughout the genus *Diabrotica*. This is true also, to some extent, of the Lemas of America; but, as a rule, the Lemas of the Old World, though often exhibiting metallic tints,

are much less varied in their markings. It would seem from this that certain species of *Lema* had departed somewhat from the style of marking prevalent in their genus in order to mimic species of *Diabrotica* living in the same localities. This view is all the more reasonable when it is taken into account that the shape of the elytra in some of the mimicking Lemas approximates more to that of the mimicked Diabroticas than to the form customary in their own genus. There are, in fact, one or two species of *Lema* with their elytra so shaped and coloured that one might almost venture to predict that they will be found to mimic species of *Galerucidæ*.

Mr. Bates has mentioned some cases of Longicorns which mimic *Galerucidæ*. One of these is *Oxylymma gibbicollis*, Bates, which, he says, closely resembles a species of *Diabrotica*.

Mr. Jacoby, without, I think, suggesting any explanation of the facts, has recorded that many of the species of his genus *Neobrotica* exhibit most striking resemblances to species of the closely-related genus *Diabrotica*.

There are a few species of other allied genera which also resemble species of *Diabrotica*. *Dircema fraterna*, described by the late Mr. Baly and originally placed by him in *Diabrotica*, has a most deceptive resemblance to *Diabrotica triplagiata*, a species from the same locality. This example is all the more remarkable, because *D. fraterna*, with its glabrous and highly polished elytra, is very unlike most of the other species of *Dircema*, which are covered with a kind of velvety pubescence.

If the species of *Diabrotica* are not favoured in some particular way, why do we find them mimicked not only by species of allied, but also by species of widely separated genera? The genus *Lema* is to be distinguished from *Diabrotica* by decided structural differences. In *Lema* the antennæ are inserted far apart, and the prothorax is narrow and cylindrical in form. In *Diabrotica* the antennæ are quite close together at their points of insertion, and the prothorax is somewhat flattened, and has sharp lateral edges. The two genera belong, in fact, to different subfamilies. Common ancestry cannot, therefore, be regarded as a possible explanation of the resemblance between species of the two genera. Similarity in their surroundings and in their habits of life

may have something to do with it. But if, as I have been led to suspect, the species of *Diabrotica* are protected by some nauseous property, this in itself would be a sufficient explanation. I have, within the last few weeks, been able to get some evidence tending to show that the species of *Diabrotica* are so protected.

Lacordaire, in his 'Mémoire sur les habitudes des Insectes coléoptères de l'Amérique méridionale'\* states, when writing of the genus *Galeruca*, that "the large species, *G. cyanipennis*, Fab., *xanthodera*, *lycoides*, Dej., &c., simulate death when captured, and secrete an abundant yellow fluid through their mouth and the joints of their legs. In another, *G. viridis*, Dej., this liquid is colourless, and sufficient in quantity to entirely cover the insect. The small species have not this faculty."† I have not been able to identify *G. cyanipennis*, Fab., but it is given in Gemminger's catalogue as a species of *Diabrotica*. The *G. viridis* of Dejean has been described by von Harold under the name of *Diabrotica marginata*. Neither of these is in the list of mimicked species which I have appended. But it is safe, I think, to assume that Lacordaire's observations apply to all the larger species of *Diabrotica*. The secretion of a special fluid of this kind is usually found to be a protection to the insect which secretes it. It might be argued that the species of *Lema* are, perhaps, similarly protected. At present there is no evidence to show this. Lacordaire has carefully noted the different genera whose species secrete a nauseous fluid, but in referring to *Lema* he does not mention this property. In reference to this point, three species of *Lema* from Borneo are very suggestive. These, at first sight, look very unlike Lemas, and might easily be mistaken for *Hispidæ*. In *Lema monstrosa*, Baly, the resemblance is greatest. The rough elytra of this species are furnished with a number of highly-raised and sharply-pointed conical tubercles. In its red-coloured thorax and black elytra it agrees with a species of *Hispa* found in the same island. You have only to imagine the very fine ends of the *Hispa*'s spines to be broken off in order to arrive at the style of armour met with in the *Lema*. The remaining two species of *Lema* mimic the *Hispa* in the same way, but to a less degree.

\* 'Annales des Sciences Naturelles,' vols. xx. and xxi.

† *L. c.*, xxi., p. 189.

The three species form, in fact, a graduated series, showing how the process of adaptation has gone on. As is the rule in such cases, the mimicked *Hispa* appears to be abundant, whereas the mimicking Lemas are apparently very rare.

As an additional reason for believing that the species of *Diabrotica* are a protected group, it may be mentioned that some of the species belonging to one section in this genus are, in colour and marking, extremely like certain species of the other section which come from the same localities. Now this, according to Mr. Wallace, is a phenomenon that does not often occur in unprotected groups, though it is frequently to be met with in protected genera.

The resemblances between species of *Neobrotica* and certain species of *Diabrotica* will probably have to be placed in the same category as those between species belonging to the two different sections of *Diabrotica*.

Fresh observations upon the species of *Lema* and *Diabrotica* in their living state will have to be made before it can be definitely established that the resemblances between them are cases of true mimicry; but the facts, so far as they are at present known, are, I submit, strongly in favour of this conclusion.

#### LIST OF THE SPECIES.

Those that closely resemble each other are bracketed together:—

	Habitat.
{ <i>Lema Batesii</i> , Baly .....	Amazons.
{ <i>Diabrotica</i> 10- <i>guttata</i> , Oliv. ....	,, and Cayenne.
{ <i>Lema oculata</i> , Lac. ....	Ecuador.
{ <i>Diabrotica</i> 10- <i>guttata</i> , Oliv., var. ...	,, , Upper Amazons.
{ <i>Lema nigrovittata</i> , Guér. ....	Mexico and N. America.
{ <i>Diabrotica vittata</i> , Fab.....	,, "
{ <i>Lema bisbivittata</i> , Clark.....	Mexico.
{ <i>Diabrotica Fairmairei</i> , Baly.....	,,
{ <i>Lema vittatipennis</i> , Baly .....	Amazons.
{ <i>Diabrotica separata</i> , Baly .....	,,
{ <i>Lema Buckleyi</i> , Baly .....	Ecuador.
{ <i>Diabrotica elegans</i> , Baly .....	,, and Colombia.
{ <i>Lema Championi</i> , Jac.....	Panama.
{ <i>Diabrotica Godmani</i> , Jac. ....	,,
{ <i>Neobrotica cœruleofasciata</i> , Jac. ...	,,

	Habitat.
{ <i>Lema biannularis</i> , Clark .....	Mexico and Guatemala.
{ <i>Diabrotica biannularis</i> , v. Harold...	„ Guatemala, and
{ <i>Neobrotica ornata</i> , Jac. ....	„ [Honduras.
{ <i>Lema ducalis</i> , .....	Colombia.
{ <i>Diabrotica elegantula</i> , Baly .....	„
{ <i>Lema semisepta</i> , Lac. ....	South Brazil.
{ <i>Diabrotica piceosignata</i> , Baly .....	„
{ * <i>D. zelota</i> , sp. n. ....	„
{ <i>Lema trivirgata</i> , Lac., var. ....	Peru. [Amazons.
{ <i>Diabrotica boliviana</i> , v. Harold ...	„ Bolivia, and Upper
{ <i>Lema Suffriani</i> , Jac. ....	Costa Rica.
{ <i>Diabrotica 9-maculata</i> , Jac. ....	„
{ <i>Neobrotica imitans</i> , Jac. ....	„
{ <i>Lema bifida</i> , Oliv. ....	Cayenne.
{ <i>Diabrotica 5-maculata</i> , Fab. ....	„
* { <i>Lema mystica</i> , Lac., var. ....	South Brazil.
{ <i>Diabrotica Clarkella</i> , Baly.....	„
{ <i>Lema dia</i> , Baly.....	Amazons.
{ <i>Diabrotica alcyone</i> , Baly .....	„
{ <i>Lema amazona</i> , Baly .....	Upper Amazons.
{ † <i>Diabrotica triplagiata</i> , Baly .....	„
{ <i>Lema dimidiaticornis</i> , de Borre ...	Mexico.
{ <i>Diabrotica lepida</i> , Say .....	„
{ <i>Lema crucifera</i> , Clark.....	Cayenne.
{ ‡ <i>Cerotoma arcuata</i> , Oliv. ....	„

\* This species may be briefly characterised as follows:—Head and hind breast black; prothorax transverse, nitid, testaceous; elytra yellowish, with the suture anteriorly, a submarginal band on each extending from the shoulder to near the apex, and a small spot on each just inside the hinder extremity of the lateral band, black. Antennæ dark brown, with the scape yellowish brown, and three or four of the apical joints pale tawny; with the third, fourth, and fifth joints thickened in the male. Legs tawny; intermediate tibiæ in the male slightly curved, thickened from above the middle to the discal extremity; intermediate femora in the male each with a small tooth a little below the middle of the ventral side. Middle legs in the female normal.

† *Dircema fraterna*, Baly, is deceptively like *Diabrotica triplagiata*, and is found in the same localities.

‡ The genus *Cerotoma* is nearly allied to *Diabrotica*.

For Explanation of Plate XVII. see next page.

EXPLANATION OF PLATE XVII.

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- FIG. 1. *Diabrotica 10-guttata*, Oliv.  
2. *Lema Batesii*, Baly.  
3. *Diabrotica 10-guttata*, Oliv., var.  
4. *Lema oculata*, Lac.  
5. *Diabrotica vittata*, Fab.  
6. *Lema nigrovittata*, Guér. .  
7. *Diabrotica triplagiata*, Baly.  
8. *Lema amazona*, Baly.  
9. *Diabrotica elegans*, Baly.  
10. *Lema Buckleyi*, Baly.  
11. *Diabrotica alcyone*, Baly.  
12. *Lema dia*, Baly.  
13. *Diabrotica lepida*, Say.  
14. *Lema dimidiaticornis*, de Borre.  
15. *Diabrotica biannularis*, v. Harold.  
16. *Lema biannularis*, Clark.  
17. *Diabrotica boliviana*, v. Harold.  
18. *Lema trivirgata*, Lac., var.  
19. *Cerotoma arcuaia*, Oliv.  
20. *Lema crucifera*, Clark.

The figures are drawn twice the natural size; the effect of which is to exaggerate the differences and diminish the resemblances between the species.